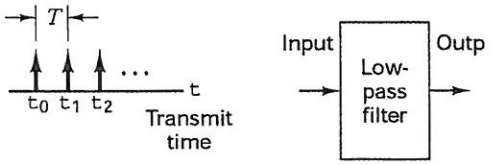
(107)輔仁大學碩士班招生考試試題	考試日期：107 年 3 月 9 日第 二 節
	本試題共 1 頁 (本頁為第 1 頁)

科目： 通訊系統　　系所組：電机工程學系

1. 試說明何謂類比通訊? 何謂數位通訊? (10)
2. 試說明類比通訊中，AM 調變、FM 調變及 PM 調變的技術各有何差異? (15)
3. 試說明數位通訊中，ASK 調變、FSK 調變及 PSK 調變的技術各有何差異? (15)
4. 試說明分頻多工(FDM)及分時多工(TDM) 兩種技術各有何差異? (10)
5. 試說明何謂匹配濾波器(Matched filter)? 何謂眼圖(eye diagram)的功用為何? (10)
6. 試說明非同調(non-coherent)調變技術要解決甚麼問題? 請舉例說明非同調調變技術的原理? (10)
7. 在數位通訊中，source coding 的主要目的為何? channel coding 的主要目的又為何? (10)
8. In a coherent FSK system, the signals $s_1(t), s_2(t)$ representing bits 1 and 0, respectively, are defined by $s_i(t) = \sqrt{\frac{2E}{T}} \cos 2\pi(f_i)t,\ 0 \le t \le T,\ i = 1,2$. Define the correlation coefficient of $s_1(t), s_2(t)$ by $\rho = \int_0^T s_1(t)s_2(t)dt$. What is the minimum value of difference frequency $|f_2 - f_1|$ for which $s_1(t), s_2(t)$ are orthogonal? (10)
9. 若輸入 digital sequences 如下圖，為了使在理想取樣輸出點上沒有 ISI 成分，此低通濾波器的 impulse response h(t)要有何特性? (10)



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(107)輔仁大學碩士班招生考試試題	考試日期：107 年 3 月 9 日第 2 節
	本試題共 1 頁 (本頁為第 1 頁)

科目： 工程數學（線性代數、微分方程）　　系所組：電機工程學系碩士班

1. For the vectors $\mathbf{a} = 2\mathbf{i} + 3\mathbf{j} + \mathbf{k}$ and $\mathbf{b} = -\mathbf{i} + 5\mathbf{j} + \mathbf{k}$

(1.1) (5%) please find the magnitude of vectors **a** and **b**

(1.2) (5%) find the angle between two vectors

2. (10%) Find the area of the triangle determined by the points $P_1(3, 0, -1)$, $P_2(2, 3, 4)$ and $P_3(1, 1, 1)$

3. (10%) The set A = $\{\mathbf{u}_1, \mathbf{u}_2\}$, where $\mathbf{u}_1 = (3, 1)$, $\mathbf{u}_2 = (1, 1)$, is a basis for R^2. Transform the set A into an "orthonormal" basis B = $\{\mathbf{v}_1, \mathbf{v}_2\}$

4. For the matrix $\mathbf{A} = \begin{bmatrix} 2 & 2 & 0 \\ -2 & 1 & 1 \\ 3 & 0 & 1 \end{bmatrix}$, please find

(4.1) (3%) the rank of **A**

(4.2) (3%) the determinant of **A**

(4.3) (3%) the trace of **A**

(4.4) (6%) the inverse matrix of **A**

5. Please find the general solution of the following first-order ordinary differential equation

(5.1) (10%) $x\frac{dy}{dx} + 6y = 3xy^{4/3}$

(5.2) (10%) $(6xy - y^3)dx + (4y + 3x^2 - 3xy^2)dy = 0$

6. (10%) Please solve for the following constant coefficient nonhomogeneous differential equation

$$y''' + y'' = 3e^x + 4x^2$$

7. (10%) Please solve for the following initial value problem using the Laplace transform method

$$y'' - y' - 6y = 0; y(0) = 2, y'(0) = -1$$

8. (15%) Find the general solution of the system using the eigenvalue method

$$x_1' = x_1 + 2x_2$$
$$x_2' = 2x_1 + x_2$$

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(107)輔仁大學碩士班招生考試試題	考試日期：107 年 3 月 9 日第 2 節
	本試題共 2 頁 (本頁為第 1 頁)

科目： 計算機概論　　系所組：電機系

1. (5%) Which of the following is not the product of IoT? (1) AlphaGo, (2) iPhone, (3) Amazon Alexa, (4) Sony Aibo 2017, (5) none of above, (6) all of above.

2. (5%) Which of the following is not an interpreted programming language? (1) XML, (2) JavaScript, (3) Python, (4) HTML, (5) none of above, (6) all of above.

3. (5%) Assuming three-digit allocation, find the fifteen's complement of +FE1. (1) 01E, (2) 12F, (3) 01F, (4) overflow, (5) underflow, (6) none of above.

4. (5%) Which of the following description regarding OSI layers is wrong? (1) Data link layer: sending a frame to the next station, (2) network layer: sending a packet from the source to the destination, (3) application layer: logging into YouTube, (4) Transport layer: sending a packet from the source to the destination, (5) none of above, (6) all of above.

5. (5%) Regarding the representation of IEEE 754 single precision binary floating-point format, which of the following description is wrong? (1) the size is 32 bits, (2) 23-bit mantissa (fraction) field is used, (3) excess-128 representation is used for the exponent, (4) 8-bit exponent field is used, (5) none of above, (6) all of above.

6. (5%) Which of the following regarding the von Neumann model is wrong? (1) We need to provide program and data for the von Neumann model. (2) The Neumann model is capable of computing anything that is computable (3) the primary difference between Turing machine and the von Neumann model is that the program is stored in the memory (4) none of the above. (5) all of above.

7. (5%) For the following "do….while" loop, how many times can it execute?

```
int counter = 5;
do {
    printf( "%d\n", counter );
} while (counter++ <= 10);
```

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科目： 計算機概論　　系所組：電機系

8. (10%) Please list the correct order of developing a C program: _____ (a) Compile, (b) Edit, (c) Execute, (d) Link, (e) Preprocess, (f) Load.

9. (12%) Following program statements, is there any error in them? Please write down your explanation.

```
switch (grade);
    case 'A': {
        ++aCount;
        continue;
    }
    case 'B': {
        ++bCount;
        continue;
    }
```

10. (10%) Please explain that what are fatal error and nonfatal error?

11. (15%) (a) An imaginary computer has four data registers (R0-R3), 1024 words in memory, and 16 different instructions. What is the minimum size of an instruction in bits if a typical instruction uses the following format: add 565 R2. (b) What is the size of program counter of the computer? (c) If the computer uses the same size of word for data and instructions, what is the size of data bus? (d) What is the size of control bus? (e) What is the size of address bus?

12. (10%) A programming language has ten different instructions. How many five-instruction programs can be written in this language if no instruction is repeated? How many eight-instruction programs

13. (8%) (a) Find the maximum value of an integer in octal with eight digits (i.e., b=8, k=8). (b) Find the minimum number of required bits to store integers less than 100,000.

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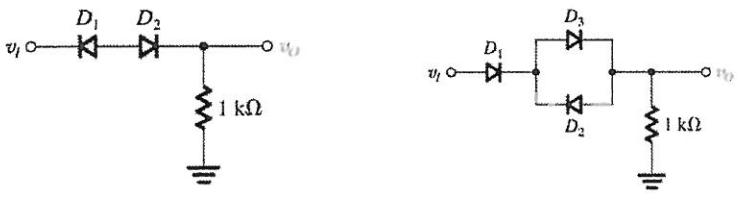
	本試題共 二 頁 (本頁為第 一 頁)

科目：電子學　　系所組：電機工程學系

1. 選擇題 (30%)： 請標明題號，作答於彌封答案卷內。
   (1) The most populate materials for the semiconductor devices are (A) Si and Ge (B) Fe and Pb (C) I and Na (D) C and S
   (2) When the density of charge carriers in a piece of semiconductor is not uniform. The generated current is caused by (A) drift (B) diffusion (C) doping (D) ion implantation.
   (3) How to forward-bias a *p-n* junction? (A) Both sides connect to positive voltage. (B) Both sides connect to negative voltage. (C) The *n* side connects to positive voltage and the *p* side connects to negative voltage. (D) The *p* side connects to positive voltage and the *n* side connects to negative voltage.
   (4) In the BJT's active mod, i_C shows a slight dependent on v_{CE}. This phenomenon is called (A) Miller effect (B) Early effect (C) Hall effect (D) Junction effect
   (5) Which one cause the gain falling off at high-frequency band of a discrete-circuit amplifier. (A) coupling capacitors (B) Miller effects (C) internal parasitic capacitors (D) bypass capacitors.
   (6) Which one is the Darlington Configuration? (A) CC-CE (B) CD-CS (C) CD-CE (D) CC-CC.
   (7) Which one is the property of the negative feedback in amplifier design? (A) Sensitize the gain. (B) Induce nonlinear distortion. (C) Extend the bandwidth. (D) Enlarge open-loop gain.
   (8) For the following MOS configurations, which one has the wide bandwidth by proper design? (A) CS (B) CG (C) CD (D) CS with degeneration
   (9) For a transresistance amplifier, its topology is (A) Series-shunt (B) Series-series (C) Shunt-shunt (D) Shunt-series.
   (10) Which circuit is **not** unconditional stable when applied as the feedback amplifier? (A) STC circuit (B) Amplifier with single pole (C) Amplifier with two poles (D) Amplifier with three poles.

2. In each of the ideal-diode circuit shown in Fig.1, v_I is a 1-kHz 10-V amplitude sin wave. Sketch the waveform resulting at v_o for 2 periods. What are its positive and negative peak values? (10%)



(a)　　(b)

Fig. 1.

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3. Derive the transfer function of the circuit in Fig.2 (for ideal op amp) and show that it can be written in that form

$$\frac{V_o}{V_i}=\frac{-R_2/R_1}{[1+(\omega_1/j\omega)][1+j(\omega/\omega_2)]}$$

where $\omega_1=1/C_1R_1$, and $\omega_2=1/C_2R_2$. Assuming that the circuit is designed such that $\omega_2 >> \omega_1$, find approximate expression for the transfer function in the following frequency region: (20%)

(1) $\omega << \omega_1$

(2) $\omega_1 << \omega << \omega_2$

(3) $\omega >> \omega_2$

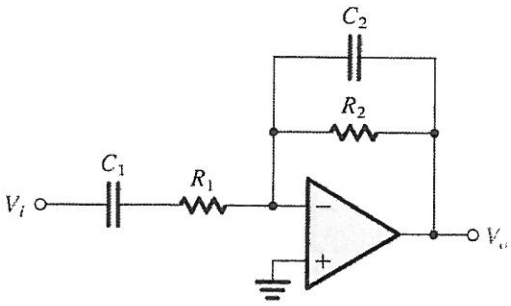

Fig. 2.

4. Consider an MOS IC CS amplifier fed with a source V_{sig} having $R_{sig}=0$ and having an effective load resistance R'_L composed of r_o of the amplifier transistor in parallel with an equal resistance r_o of the current-source load. (20%)

(1) Sketch the high frequency small signal equivalent circuit, and find $V_o(s)/V_{sig}(s)$.

(2) Sketch the Bode plot for the gain of circuit in 4.(1).

(3) Let g_m=1.2 mA/V, r_o=20kΩ, C_{gs}=20fF, C_{gd}=5fF, and C_L=25fF, find A_M, f_H, f_t, and f_z.

5. The operational amplifier in Fig.3 has open-loop gain of 10^6, input resistance of 100 kΩ and output resistance of 1kΩ. As R_L=2kΩ, R_1=1kΩ, R_2=1MΩ, and R_s=10kΩ, find the closed loop gain V_o/V_s, input resistance R_{in} and the output resistance R_{out} of Fig. 3 by using the feedback analysis. (Hint: You **cannot** regard the op amp as ideal.) (20%)

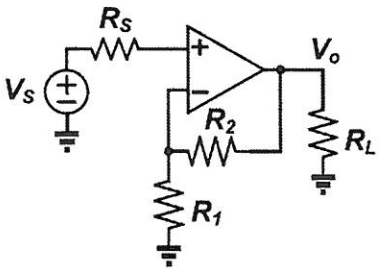

Fig. 3.